

Figs. 6A and 6B show a structure of a tip portion 82a of the fuel injection valve body according to a fifth embodiment of the invention. Fig. 6A is a front view and Fig. 6B is a longitudinal sectional view. The fifth embodiment differs from the first embodiment in that a tip portion 84a of a cap 84 and a nozzle body tip portion 83a form a continuous tip portion, and the entire continuous tip portion protrudes in a spherical shape. A nozzle hole 86 is opened near an apex of the nozzle body tip portion 83a. Other constructions of the fifth embodiment are the same as those of the first embodiment.

The following effects can be obtained from the fifth embodiment described as above.

- (i) The same effects as those described in (i) of the first embodiment and in
- (ii) of the second embodiment can be generated.

[A sixth embodiment]

Figs. 7A and 7B show a structure of a tip portion 92a of the fuel injection valve body according to a sixth embodiment of the invention. Fig. 7A is a front view and Fig. 7B is a longitudinal sectional view. The sixth embodiment differs from the fifth embodiment in that a tip portion 94a of a cap 94 extends along a nozzle body tip portion 93a and covers a part of the nozzle body tip portion 93a through a gap 95. A nozzle hole 96 is opened near an apex of the nozzle body tip portion 93a. Other constructions of the sixth embodiment are the same as those of the third embodiment.

The following effects can be obtained from the sixth embodiment described as above.

(i) The same effects as those described in (i) of the first embodiment and in (ii) of the third embodiment can be generated.

[A seventh embodiment]

Figs. 8A and 8B show a structure of a tip portion 102a of the fuel injection valve body according to a seventh embodiment of the invention. Fig. 8A is a front view and Fig. 8B is a longitudinal sectional view. The seventh embodiment differs from the third embodiment in that the entire nozzle body tip portion 103a does not protrude, but only a central portion 103b protrudes in a conical shape and a foremost portion 103c thereof forms a spherical shape, though a peripheral portion 103d is a plane perpendicular to an outer peripheral surface 103e. As a result, a recessed portion 103f is formed in the nozzle body tip portion 103a. The recessed portion 103f is covered with a tip portion 104a of a cap 104 through a gap 105. Other constructions of the seventh embodiment are the same as those of the third embodiment.

The following effects can be obtained from the seventh embodiment described as above.

(i) A part of the nozzle body tip portion 103a, particularly, in this embodiment, the peripheral portion 103d and the recessed portion 103f are covered with the tip portion 104a of the cap 104 through the gap 105. This reduces an area, which is exposed directly to a combustion flame, of the nozzle body tip portion 103a. Particularly, either the peripheral portion 103d or the recessed portion 103f is not exposed directly to a combustion flame. This prevents the temperature of the nozzle body tip portion 103a from increasing. Even if the temperature of the tip portion 104a of the cap 104 increases, the gap 105 blocks a direct transfer of heat to the

nozzle body tip portion, which prevents the temperature of the nozzle body tip portion 103a from increasing. The temperature of a nozzle hole 106 can be prevented from increasing and accumulation of deposits can be restricted.

[An eighth embodiment]

Figs. 9A and 9B show a structure of a tip portion 112a of the fuel injection valve body according to an eighth embodiment of the invention. Fig. 9A is a front view and Fig. 9B is a longitudinal sectional view. The eighth embodiment differs from the seventh embodiment in that a central portion 113b of a nozzle body tip portion 113a, which is covered with a tip portion 114a of a cap 114 through a gap 115, protrudes in a spherical shape. A nozzle hole 116 is opened near an apex of the nozzle body tip portion 113a. Other constructions of the eighth embodiment are the same as those of the seventh embodiment.

The following effects can be obtained from the eighth embodiment described as above.

(i) The same effects as those described in (i) of the seventh embodiment can be generated.

While the invention has been described with reference to preferred embodiments thereof, it is to be understood that the invention is not limited to the preferred embodiments or constructions. To the contrary, the invention is intended to cover various modifications and equivalent arrangements. In addition, while the various elements of the preferred embodiments are shown in various combinations and configurations, which are exemplary, other combinations and configurations,